

The carapace of this unusual specimen is chocolate-brown, the vertebral keel brownish-yellow edged with dark brown. The plastron is chrome yellow with a single large chocolate-brown patch in the middle, and inframarginals of the same colour, as opposed to the usual plastral pattern of dark brown spots on a yellow-brown background. The head is brown with a yellow spot and streak behind each eye.

The known range of the species is therefore Tirap District, Arunachal Pradesh and Garo Hills, Meghalaya, possibly also North Cachar Hills, Assam, in India. Extralimitally, it is

known from Chiang Rai, Chiang Mai and Mae Hong Son Provinces in Thailand, Laos, Vietnam and Namfong in Hainan, China.

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## 22. BREEDING THE KING COBRA (*OPHIOPHAGUS HANNAH*) IN CAPTIVITY (With a photograph)

In December 1982 the Madras Snake Park Trust (MSPT) obtained on breeding loan a 4.0 m, 6.5 Kg. male king cobra (*Ophiophagus hannah* Cantor) from the Mangalore Wildlife Trust in Karnataka to mate with the Park's three six year old females which were born and raised in captivity. Copulation between the male and the smallest of the three females was observed on several occasions in February 1982. Forty five days after the last observed

mating this female laid a clutch of 23 premature, unviable eggs under a small mound of bamboo leaves that she had gathered from the floor of the enclosure. Another female that had appeared to be gravid did not lay any eggs. Our first attempt to breed king cobras in captivity was therefore unsuccessful.

In November 1983 the experiment was tried again with the same male. Matings occurred in February and March 1984 and resulted in

the smallest female laying again, this time a total of 24 eggs of which 6 were unshelled, 6 shelled but infertile and 12 fertile. The eggs were discovered by the keeper on 26 April 1984 at 8.30 a.m. and were presumed to have been deposited the previous night. The eggs were situated in a saucer-like depression in the enclosure floor and covered over by a small mound of bamboo leaves gathered by the female. A week later the eggs were removed for artificial incubation as conditions inside the enclosure were not ideal for this purpose. 11 out of the 12 fertile eggs (i.e., 92% of the fertile eggs) hatched successfully between 28 June and 1 July 1984 after an incubation period of 63 to 66 days. This is perhaps the first time that this species, the longest venomous snake in the world, has been bred in captivity outside the united States of America.

INTRODUCTION

An excellent review of the literature pertaining to the reproductive habits of the king cobra is given by Oliver (1956) who also documented in considerable detail the captive breeding exercises for this species at the New York Zoological Park in the United States (Oliver 1956 and 1957). Burchfield (1977) reported on the captive breeding efforts at the Gladys Porter Zoo in Texas.

Since our observations on courtship, mating and oviposition compare closely to the accounts given by the authors cited above I have avoided treating these aspects in detail here. The emphasis of this paper is on care of animals, incubation techniques for eggs and rearing of young under conditions prevailing in Indian zoos.

TABLE 1  
BREEDING RECORDS FROM OTHER INSTITUTIONS

Institution	Year	Mating	Oviposition	Eggs	Hatchlings	% Success	Source
New York Zoo, U.S.A.	1955	10 Mar.					
		14 Mar.					
		18 Mar.	24 Apr.	41	14	34%	Oliver, 1956
	1956	16 Jan.					
		17 Jan.					
		26 Jan.					
1957	8 Mar.						
	14 Mar.	24 Apr.	51	0	0	Oliver, 1956	
Gladys Porter Zoo, Texas, U.S.A.	1957	—	24 Apr.	56	39	70%	Oliver, 1957
	1974	8 Mar.	28 Jun.	28	19	68%	Burchfield, 1977
	1975	26 Apr.	17 Jun.	28	0	0	Burchfield, 1977

TABLE 2  
BREEDING DATA (MSPT): MATING

Mating	Time	Duration	Female No.	Temperature
23.2.83	0745 Hrs.	45 min.	3	21°C
26.2.83	1005 Hrs.	67 min.	3	26°C
06.3.83	1400 Hrs.	45 min.	1	26°C
11.2.84	0600 Hrs.	95 min.	3	21°C
13.3.84	0745 Hrs.	45 min.	?	21°C

TABLE 3  
BREEDING DATA (MSPT): EGGS

Female No.	Oviposition	Gestation	No. of eggs	Incubation	Date of hatching
3	14 Apr. 1983	45 days	23	—	eggs unviable
3	19-25 Apr. 1984	66 days	24	63-66 days	28.6-1.7.84

#### *History of the MSPT king cobras:*

The three female king cobras are the survivors of a clutch of 20 eggs collected from a wild nest 100 m from a mangrove in Panighat in the Andaman Islands. The eggs were resting on a compressed pad of bamboo leaves, one inch thick and covered over by a mound of bamboo leaves 12 inches high and 36 inches in diameter. The female was in attendance, resting coiled over the nest mound. She measured 7 feet in total length and did not display any sign of aggression or resistance at being captured. The average measurement of the eggs was 65 mm × 30 mm. A single egg was cut open at the nest site to reveal a fully developed embryo measuring 33.5 cm. Air temperature measured at the nest site at 0600 hrs. and 1800 hrs. were 26°C and 29°C respectively. Nest temperature at 0600 hrs. was 28°C, 2°C higher than the surrounding air temperature.

The female and her clutch of eggs were brought back to MSPT where 19 of the 20 eggs hatched beginning on 8th July 1976, 23 days after collection. Average total length of the hatchlings was 45 cm. All the hatchlings sloughed for the first time between 15 and 18 July, 7 to 10 days after hatching. From 20 July onwards they were offered a variety of food including hatchling water snakes (*Xenochrophis piscator*, *Aretium schistosum*) and striped keel backs (*Amphiesma stolata*), a common grass snake. However, all except the three females died within six months of their birth. (Romulus Whitaker, pers. comm.)

#### *Housing:*

The three surviving females, now over 10 years old, measure between 3.0 and 3.5 m in length. From the slight differences in their size and hood markings it is possible to distinguish them as snakes 1, 2 and 3. Until two years of age they were housed in individual boxes, 6 feet × 1 ft. × 1 ft. in a semi-darkened, air-cooled room. In 1979 they were put on public display, one at a time, housed in a glass fronted wooden enclosure measuring 6 ft. × 3 ft. × 3 ft. This cage had a small door at the back which led into a similar sized cage inside the air cooled room. The snake on display was thus free to choose the enclosure of its preference and went through a gradual acclimatization to the local climate.

In 1981 a bigger enclosure was built to accommodate all three females at the same time. This, the present arrangement, consists of two interconnected enclosures placed side by side (henceforth to be referred to as units A and B). Unit A is a glass fronted room approximately 12 ft. × 5 ft. × 6 ft. with a keeper entrance at one end. A small door at the opposite end communicates with unit B which is approximately 7 ft. × 6 ft. × 6 ft. This enclosure is constructed of weld mesh and has a keeper entrance at the other end.

Unit A has a mud floor covered with a thick layer of dry bamboo leaves. A desert air cooler placed outside the enclosure maintains the summer day temperature inside the enclosure at 26° to 30°C. Two cement bowls provide drinking water. Unit B has a thick layer of soil and is landscaped with grass, logs, rocks

and plants. A creeper (*Vernonia* sp.) on the roof partially shades the enclosure.

The snakes spend the cooler hours of the day during summer and most of their time during the cooler months of the year basking or resting in Unit B. Apparently because they are free to move at will from one enclosure to the other to suit their thermoregulatory requirements the snakes seem to have adjusted well to the predominantly hot climate of Madras.

*Feeding:*

The MSPT king cobras are fed once a week. The preferred, and hence proffered, food item is chequered keelback water snakes (*Xenochrophis piscator*). The water snakes fed to the king cobras are normally quarantined for a week prior to the feeding date and dosed

with Mebendazole, a broad spectrum anti-helminth, as a precautionary measure. The snakes are fed alive but always under the supervision of the keeper to prevent any mishaps.

*Breeding notes: egg incubation*

The following procedure, adopted for incubation of the 1984 clutch of king cobra eggs, has proven its worth in the incubation of the eggs of several species of snakes.

The female was first removed from her position on the nest mound (the MSPT king cobras are quite tame). After being uncovered but before being removed the eggs were marked on top with a lead pencil to ensure that they could be reoriented properly in the incubator. The eggs were then measured and weighed.

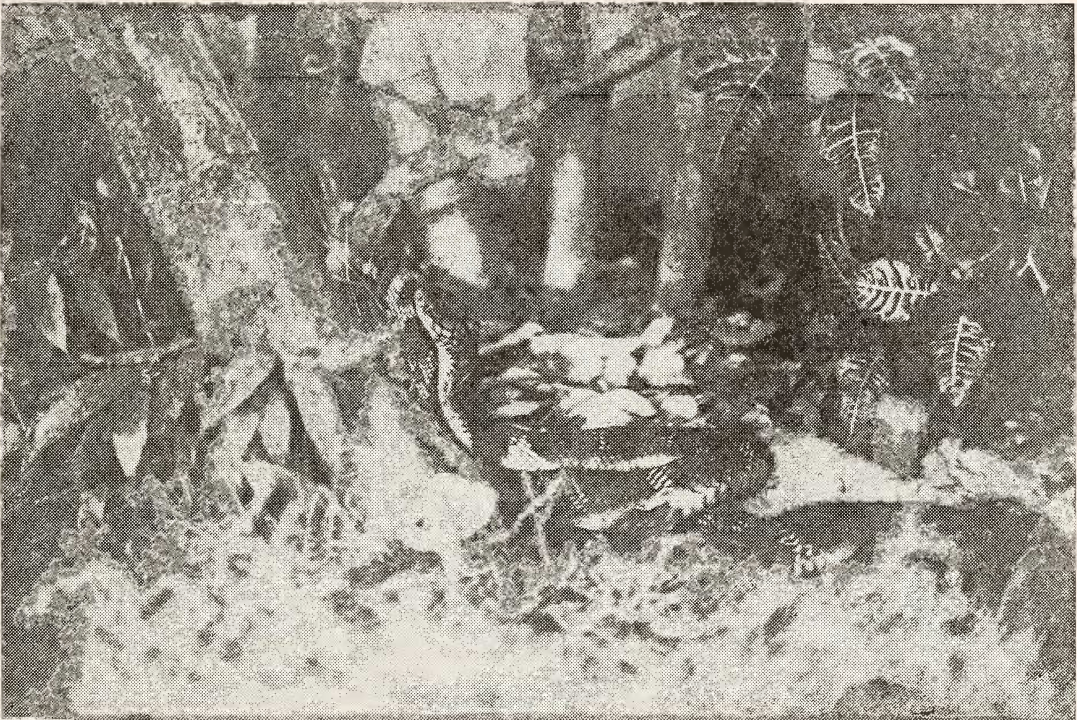


Photo. 1. King Cobra mating.

TABLE 4  
EGG MEASUREMENTS

	Length	Diameter
Mean	: 56.8 mm	42.6 mm
Minimum	: 48.0 mm	24.0 mm
Maximum	: 64.5 mm	38.0 mm

Fertility was assessed by candling. This technique, long in use in poultry management, is highly useful to the reptile captive breeder. A circular piece of tin or card with a small centrally placed hole in it is fitted in front of an ordinary table lamp. The light is switched on in a darkened room and the egg is held in front of the hole. Blood vessels and other signs of embryonic development can be seen in fertile and developing eggs, even within a week after they are laid. The alternative technique to gauge fertility of a clutch of eggs by cutting open one or two is, as Ross (1980) rightly points out, useless and wasteful "in as much the egg opened, if fertile, may actually be the only fertile egg, and if infertile, may be the only infertile egg". In our experience candling works with the eggs of all species of snakes in our collection with the exception of python eggs whose shells are too thick for the light to show through.

The fertile eggs were divided into three groups of four eggs each and each group was placed inside a polythene bag, over a substrate of damp cotton wool or newspaper. The bags were fully inflated by mouth and closed tightly

by means of rubber bands. Further inflation was done as and when required. The substrate was also wetted when required (Dattatri 1985). All the plastic bags were placed inside a cross-ventilated wooden box, over a layer of bricks.

A desert air cooler placed two feet away kept the air inside the wooden box at the right temperature and humidity. If the temperature within the box had to be further lowered, the bricks on the floor of the box were wetted. The entire box was elevated on a stool, the legs of which stood in small basins of water to deter ants from climbing into the box. Temperature inside the box was monitored constantly and recorded three times a day. Humidity inside the box was maintained at 75 to 90% as measured by a cyclometer. The cotton wool substrate had to be replaced on two occasions due to growth of fungus.

A close watch was kept on the eggs and when the first slit appeared in one of them they were all removed to plastic bread boxes to hatch. The hatchlings were measured, weighed, sexed and placed one each in a glass fronted wooden box 15 inches × 8 in. × 7 in. Each box had a layer of newspaper on the floor, covered by a layer of green leaves and a thin green leaved branch, giving the hatchlings a choice of substrates to rest upon or under. A small bowl of water was provided for drinking. In addition a little water was sprayed on the leaves of the branch, as many young snakes prefer drinking this way.

TABLE 5  
INCUBATION TEMPERATURE (°C)

9.00 Hrs.			12.00 Hrs.			18.00 Hrs.		
Average	Min.	Max.	Average	Min.	Max.	Average	Min.	Max.
29.5	28.5	31	29.2	27.8	31.5	29.3	27	32

TABLE 6  
HATCHLING MEASUREMENTS

Total length (N=6)	Weight (N=11)
Average : 46.7 cm.	14 gms.
Minimum : 45.5 cm.	99 gms.
Maximum : 49 cm.	17 gms.

All eleven hatchlings shed their first skins between 7 and 9 days after hatching. Commencing on day 10 a variety of food was offered to them. This included small sized

skinks — juvenile *Mabuya carinata*, *M. bibroni* and *Riopa punctata* — and hatchling snakes — *Xenochrophis piscator*, *Atretium schistosum*, *Amphiesma stolata* and *Cerberus rhynchops*. However, all the hatchling king cobras refused to feed. Some responded well initially to assisted feeding — i.e., they swallowed dead snakes which were placed in their mouths. The others were force fed as a last resort. Despite these efforts the baby king cobras died one after the other, for no apparent reason, within two months after hatching.

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### 23. A LIST OF THE SNAKES OF THE BHAVNAGAR DISTRICT, GUJARAT STATE

Bhavnagar District is situated along the Bay of Cambay, at c. 21.46°N latitude, 72.11°E longitude. The area is arid and dry with scanty rainfall and the forests are dry thorny deciduous the rocky and hilly area of forest land is estimated to be about 15061.67 hectares in this District, while 15928.07 hectares are grasslands.

#### Family TYPHLOPIDAE

- (1) *Typhlops porrectus*, Stoliczka, 1871  
Common, seen under stones, logs and

moist soil in gardens and also occasionally in side houses.

- (2) *Typhlops braminus* (Daudin, 1803)  
Very common.

#### Family: BOIDAE

- (3) *Python molurus* (Linnaeus, 1758)  
One young specimen was collected on Palitana hills.
- (4) *Eryx conicus*, (Schneider, 1801)  
Very common. A female in captivity delivered three young in August.